FIRE ALARM SYSTEMS

INSTALLATION

TESTING

MAINTENANCE

REVISED 1988

Alberta

LABOUR
General Safety Services Division

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FIRE ALARM SYSTEMS MANUAL

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Revision No.	Date
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B. Glossary of Fire Alarm Terms

AIR HORN - A device operated by air in which a vibrating reed or column of air produces sound.

ALARM SIGNAL - An audible or visual signal transmitted throughout a building to advise occupants that a fire emergency exists.

ALERT SIGNAL - An audible signal to advise designated persons of a fire emergency prior to the transmittal of an alarm signal.

ANCILLARY DEVICE - A device actuated by a fire alarm system but which is not required to be part of the fire alarm system.

ANNUNCIATOR - A device to visually indicate that a signal has been received from a fire alarm system and to identify the building zone containing the actuating device.

AUDIBLE SIGNAL APPLIANCE - A device to indicate by means of sound output that the fire alarm system has been actuated.

AUDIT - A procedure involving the examination and testing of an existing fire alarm system to identify the type and design, and to establish that the equipment will perform its function.

AUTHORITY HAVING JURISDICTION - An inspector appointed pursuant to Section 2 of the Uniform Building Standards Act, to Section 6 of the Electrical Protection Act or to Section 2 of the Fire Prevention Act; or a Local Assistant appointed pursuant to Section 4 of the Fire Prevention Act.

AUTOMATIC ALARM INITIATING DEVICE - A device which automatically transmits an alarm signal when activated e.g., heat detectors, smoke detectors and waterflow devices.

AUXILIARY ALARM SYSTEM - A system connected to the municipal fire alarm system to transmit an alarm signal to the fire department.

BELL - A sounding device with an electro-mechanically or electromagnetically operated striker which strikes a gong to produce a ringing sound.

BUILDING - A structure used or intended for supporting or sheltering any use or occupancy.

BUZZER - An electrically operated device which produces a buzzing sound.

CENTRAL STATION - A building or premises where persons are on duty to receive signals that give information of fire or alarm system faults in protected premises.

COMPONENT, NON-RELIABLE - A component which is likely to fail during the anticipated service life of an assembly. Typical

I. GENERAL

A. Preface

This manual has been prepared by the Building Standards Branch in consultation with the Electrical Protection Branch, the Fire Prevention Branch and representatives of electrical installers, fire alarm component suppliers and professional engineers.

The manual consolidates the requirements for fire alarm systems of the Alberta Building Code 1985, the Alberta Fire Code and documents referenced in these two Codes. It is anticipated that this consolidation of requirements will be of value to all who deal with fire alarm systems.

References noted in the margins are to the documents which contain the requirement discussed in the adjacent paragraph. The abbreviations have the following interpretation:

ABC85 2.3.3. refers to Sentence 2.3.3. of the Alberta Building Code 1985.

S524 3.5.1. refers to Sentence 3.5.1. of CAN4-S524 Standard for the Installation of Fire Alarm Systems.

AFC580 refers to Section 580 of the Alberta Fire Code.

QB-APR84 refers to Electrical Protection Branch Quarterly Bulletin dated April, 1984.

INSPECTION - A routine visual check by a building owner, or designated person, to ensure that a fire alarm system and its component parts have not been tampered with or obstructed and to determine the status of the system's monitoring indicators.

LINE-TYPE DETECTOR - A detector in which the heat sensing element is continuous along a line.

MAIN POWER SUPPLY - A primary source of electrical energy used to power a fire alarm system.

MAINTENANCE - Includes inspection, testing and repair required to keep a fire alarm system and its component parts in an operative condition at all times.

MANUALLY ACTUATED SIGNALLING BOX - A device which initiates a signal when operated manually.

MOTOR DRIVEN HORN - An electrically operated device in which the action of a motor driven actuator against a diaphragm produces sound.

PROPRIETARY CONTROL CENTRE - A continually supervised station under the control of the owner or others interested in the building or buildings to be protected that conforms with the requirements for Class A proprietary signalling systems in N.F.P.A. 72D, "Installation, Maintenance and Use of Proprietary Protective Signalling Systems".

RATE-OF-RISE DETECTOR - A detector which operates when the rate of temperature rise at the detector exceeds a pre-determined level.

SENSITIVITY - A term to describe the relative degree of response of a detector. A detector of high sensitivity responds to a lower concentration of smoke than a low sensitivity detector under identical fire test conditions.

SINGLE STROKE BELL - A bell whose gong is struck only once each time operating power is applied.

SINGLE STROKE CHIME - A device which produces a soft musical tone once each time the operating power is applied.

SMOKE ALARM - A combined smoke detector and audible alarm device designed to sound an alarm within the room or suite in which it is located upon the detection of smoke within that room or suite.

SMOKE DETECTOR - A fire detector designed to operate when the concentration of airborne combustion products exceeds a pre-determined level.

SPOT-TYPE DETECTOR - A detector in which the heat sensing element is a compact unit of small area. This is the most common type.

examples of such components include electronic tube heaters, blower motors, electrolytic capacitors and heating elements.

COMPONENT, RELIABLE - A component which is not expected to fail or to need periodic replacement and does, therefore, not need to be supervised.

CONTROL UNIT - A device with the necessary components and circuitry to furnish power to control devices of the fire alarm system, to receive signals from manually actuated signalling boxes and fire detectors, to transmit signals, to provide electrical supervision and to control the operation of ancillary devices.

ELECTRIC SIREN - A motor driven device in which air is forced intermittently through openings to produce sound.

ELECTRICAL SUPERVISION - A means to detect a fault condition which would interfere with the normal operation of a circuit in a fire alarm system.

END-OF-LINE DEVICE

(a) END-OF-LINE RECTIFIER - A device which permits a pulsating direct current to bleed through the alarm initiating circuit for the purpose of electrical supervision but which blocks the passage of alternating current.

(b) END-OF-LINE RESISTOR - A resistor used to terminate an electrically supervised line. The resistor is used to make the line electrically continuous and to provide a fixed reference for current and/or resistance against which to evaluate changes that produce an alarm signal.

FIRE ALARM SYSTEM - A combination of devices designed to warn building occupants of a fire condition.

FIRE DETECTOR - A device which detects a fire condition and automatically actuates an alert or alarm signal (see also Heat Detector and Smoke Detector).

FIXED-TEMPERATURE DETECTOR - A detector designed to operate when the temperature at the detector exceeds a pre-determined level.

FLOOR AREA - A space on any storey of a building between exterior walls and required firewalls, including the space occupied by interior walls and partitions, but not including exits and vertical service spaces that pierce the storey.

GONG - A part of a bell, usually dish-shaped, which reverberates when struck producing a ringing sound.

HEAT DETECTOR - A fire detector designed to operate at a pre-set temperature or rate of temperature rise.

C. Applicable Standards

The following Standards are referenced in the Alberta Building Code 1985 and/or the Alberta Fire Code.

CAN4-S524	Standard for the Installation of Fire Alarm Systems
ULC-S525	Standard for Audible Signal Appliances for Fire Alarm Systems
ULC-S527	Standard for Control Units for Fire Alarm Systems
ULC-S528	Standard for Manually Actuated Signalling Boxes for Fire Alarm Systems
ULC-S529	Standard for Smoke Detectors for Fire Alarm Systems
ULC-S530	Standard for Heat Actuated Fire Detectors for Fire Alarm Systems
ULC-S531	Standard for Smoke Alarms
CAN4-S536	Standard for the Testing, Inspection and Maintenance of Existing Fire Alarm Systems
CAN4-S537	Standard for the Verification of Fire Alarm System Installations
CSA-C22.1	The Canadian Electrical Code, Part I, Fourteenth Edition
CSA-C282	Emergency Electrical Power Supply for Buildings
NFPA13	Installation of Sprinkler Systems
NFPA71	Installation, Maintenance and Use of Central Station Signalling Systems
NFPA72D	Installation, Maintenance and Use of Proprietary Protective Signalling Systems

The following documents make reference to the installation of fire alarm systems.

QB-OCT83 QUARTERLY BULLETIN, ELECTRICAL PROTECTION BRANCH
QB-APR84
QB-JULY85

STANDBY POWER SUPPLY - A secondary source of electrical energy, independent of the main power supply, used to power a fire alarm system in the absence of the main power supply.

TESTING - A procedure used to determine that a fire alarm system and its components function as intended.

TROUBLE SIGNAL - A signal intended to indicate a fault or trouble condition such as an open circuit or short circuit condition of a component in a device, an open circuit or ground fault in the installation wiring or depletion of the supply battery.

VERIFICATION - A procedure involving the examination and testing of a new fire alarm system to ensure that the supply, installation and operation of the equipment is as specified and that the system will perform its intended function as outlined in the Alberta Building Code and is installed in accordance with the Canadian Electrical Code, Part I, and ULC Standard CAN4-S524, "Standard for the Installation of Fire Alarm Systems".

VISUAL SIGNAL APPLIANCE - A device to visually indicate the actuation of the fire alarm system.

VIBRATING BELL - A bell in which the gong is struck repeatedly for as long as operating power is applied.

VIBRATING CHIME - A device which produces a soft musical tone repeatedly for as long as operating power is applied.

VIBRATING HORN - An electrically operated device in which the action of a vibrating arm against a diaphragm produces sound.

WATER FLOW DETECTING DEVICE - An electric signaling indicator or alarm check valve actuated by water flow in one direction only.

ZONING - A subdivision of a fire alarm system into zones by wiring areas separately.

The plans of the building must show the proposed location of all of the devices that make up the fire alarm system as well as any ancillary devices. These devices would include the control unit, annunciator(s), pull stations, smoke and heat detectors, end-of-line devices, speakers, telephones, door hold-open devices, etc. S524 3.5.2

The submission must include a wiring diagram that shows the connecting wiring of the system components including the connection of the power supply. Along with this diagram there must be a written description of the sequence of operation for the fire alarm system. S524 3.5.3

II. DESIGN AND INSTALLATION OF FIRE ALARM SYSTEMS

A. Permits for Fire Alarm Systems

An electrical permit must be obtained for the installation of a fire alarm system. This also applies to the installation of additional devices on an existing system and to the relocation of existing devices.

The fire alarm system may be covered under the same permit as the building wiring where the installation is done by the same electrical contractor. Some municipalities require a separate permit. The functional system and location of components of the fire alarm system are normally covered by the building permit. However, where additions or renovations of the building structure are not undertaken in conjunction with the installation of, or additions to, a fire alarm system, a building permit may be required in addition to the electrical permit. In this situation the Electrical Protection Branch inspector will notify the local building inspection authority that an electrical permit has been issued for the work.

To obtain a building permit the application must be accompanied by plans and specifications for the project as required by the authority having jurisdiction. The Alberta Building Code 1985 requires the following information about fire protection components: ABC85 1.5.1.2.(1)(c)

i. the division of the building by firewalls;

ii. the building area;

iii. the degree of fire separation of storeys, shafts and special rooms or areas, including the location and rating of closures in fire separations;

iv. the source of information for fire-resistance ratings of elements of construction;

v. the location of exits; and

vi. fire detection, suppression and alarm systems.

While only item (vi.) deals specifically with fire alarm systems, the other information is necessary to properly review the fire alarm system. ABC85 2.3.3.

In addition to the information required by the Alberta Building Code 1985, CAN4-S524 requires that plans and specifications of the fire alarm system be submitted to the building inspector. These plans and specifications must contain enough information to allow the building inspector to confirm that the system meets the minimum requirements of the standard. The standard states that the plans and specifications must be acceptable before work starts. S524 3.5.1

SUMMARY OF TABLES 3.2.4.A. and 9.10.17.A.

MAJOR OCCUPANCY	OCCUPANT LOAD ABOVE WHICH A FIRE ALARM SYSTEM IS REQUIRED
Licensed beverage establishments & restaurants (Group A-2)	150
Schools & Colleges (Group A-2)	40
Assembly occupancies in which provision is made for the congregation or gathering of persons for the purpose of participating in or viewing open air activities (Group A-4)	300 below the seating area
Institutional occupancies in which persons are detained for penal or correctional purposes or for involuntary detention or whose liberties are restricted (Group B-1)	0
Institutional occupancies in which persons require special care or treatment because of age, mental or physical limitations (Group B-2)	10
Residential occupancies (Group C)	10 having sleeping accommodation
High hazard industrial occupancies (Group F-1)	25
Medium or low hazard industrial occupancies (Group F-2 or F-3)	75 above or below the first storey

ABC85
Table
3.2.4.A.
Table
9.10.17.A.

B. General Requirements

1. Introduction

Fire alarm systems designed to alert the occupants to the presence of a fire to enable them to evacuate must be installed in certain buildings.

Fire alarm and voice communication systems are to be installed in conformance with CAN4-S524, "Standard for the Installation of Fire Alarm Systems", and before being accepted by the authority having jurisdiction must be verified in accordance with CAN4-S537, "Standard for the Verification of Fire Alarm System Installations". ABC85 3.2.4.5.(1) 3.2.4.5.(2)

2. Where Required

A fire alarm system must be installed in every building that has four storeys or more except as outlined in section 3 following. These storeys shall include all basement levels. (See Appendix A for discussion of differences in Code interpretation of the number of storeys in a building as opposed to the building height in storeys). ABC85 3.2.4.1.(1) 9.10.17.2.

A fire alarm system is also required in buildings containing a total occupant load of more than 300, other than in open air seating areas. ABC85 3.2.4.1.(1) 9.10.17.2.

Further, a fire alarm system is required if a building has a total occupant load of more than 150 above or below the first storey, other than in open air seating areas. ABC85 3.2.4.1.(1)

The major occupancy classification and the number of people who might be expected to be in the building (the occupant load) may dictate the need for a fire alarm system regardless of the number of storeys in a building. The following table lists the maximum allowable number of people that may occupy buildings of different occupancy classifications before a fire alarm system is required. When the number of people who may occupy the building is calculated and it exceeds the number shown in the table a fire alarm system must be installed. ABC85 3.2.4.1.(1)

Occupant loads which differ from the tabulated values are allowed. ABC85 3.1.14.1.

This provision for continuity affects buildings containing more than one major occupancy where a two stage system is installed in one occupancy and a single stage system in the other. This may be wholly or partly by choice of the designer or because of Code requirements. If the situation occurs it is suggested that the single and two stage systems be interconnected and the following sequence of operations be provided: ABC85 3.2.4.2.(3)

Case 1: system is actuated in major occupancy with single stage installed:
- alarm sounds throughout the major occupancy with single stage system,
- alert sounds at monitoring stations in other occupancy.

This transfers automatically to alarm if operation sequence is not discontinued by authorized personnel. The alert signal would be coded so as to identify the source of the alarm.

Case 2: system is actuated in major occupancy with two stage installed:
- alert sounds at prescribed stations in the major occupancy with two stage system. At this time no signals are initiated in the other major occupancy,
- if the emergency condition continues and the alert signal transfers to an alarm, the alarm would sound throughout both major occupancies.

A fire alarm system cannot be installed in only a part of a building. If a fire alarm system is required in any portion of a building it must be installed throughout the whole building.

There are two exceptions to the previous paragraph. The first is that if a building is divided by a firewall and there is no access or openings such as for heating ducts through the firewall from one side to the other then each side may be treated as a separate building for fire alarm purposes. The second is that if a building which is not more than three storeys in building height has a vertical fire separation that has at least a 1 hour fire-resistance rating and there is no access or openings through the fire separation then each part may be treated as if it were a separate building. This second exception does not, however, allow the treatment of storage rooms and service rooms as separate building from the space that they serve. ABC85 2.1.6.1. ABC85 3.2.4.2.(4) 9.10.17.9. ABC85 3.2.4.2.(5) 9.10.17.10.

5. Terminology

Some of the terms that are used in descriptions of fire alarm systems will be discussed in this section.

3. Where NOT Required

There are three exceptions to the requirements in 2. above for a fire alarm system. All exceptions apply to residential buildings (Group C).

The first exception applies to a building that contains only dwelling units (apartments). If the means of egress is arranged so that no more than 4 dwelling units share a public corridor or an exit a fire alarm system is not required. ABC85 3.2.4.1.(2) 9.10.17.3.

The second exception also applies to buildings that contain only dwelling units (apartments). If the following criteria are met a fire alarm system is not required:

i. the building is three storeys or less in building height; and

ii. each dwelling unit has a door that opens
    i. directly to the outdoors at ground level, or
    ii. onto a balcony that has an exit stair to ground level.

ABC85 3.2.4.1.(2)

The third exception applies to hotels or motels. If the following criteria are met a fire alarm system is not required:

i. the building is three storeys or less in building height; and

ii. each suite has a door that opens
    i. directly to the outdoors at ground level, or
    ii. onto a balcony that has an exit stair to ground level.

ABC85 3.2.4.1.(3)

Where a fire alarm system, or part of a system, is installed in a building when it is not required by the Alberta Building Code, the installation must be in accordance with CAN4-S524- "Standard for the Installation of Fire Alarm Systems". ABC85 3.2.4.5.(1)

4. Continuity of a Fire Alarm System

If access is provided through a firewall other than for piping, tubing, wiring or conduit fire alarm requirements are applied to the areas on both sides of the firewall as if they were in the same building. ABC85 3.2.4.2.(1) 9.10.17.1.

If a building has two or more major occupancies and if a fire alarm system is required for any reason then only a single system is allowed to be installed in the building and it must serve all occupancies. The type of operation of the system in each major occupancy must be the type of operation required by that major occupancy. ABC85 3.2.4.2.(2) 9.10.17.8.

C. Types of Fire Alarm Systems

1. Introduction

The Alberta Building Code 1985 recognizes two different types of fire alarm systems. These are discussed below.

2. Single Stage System

In a single stage system actuation of an alarm initiating device causes the system to go into the alarm mode with all of the audible signal appliances such as bells or horns in the system sounding an alarm signal. ABC85 3.2.4.4.(1)

3. Two Stage System

In a two stage system actuation of an alarm initiating device causes the system to go into the alert mode with some or all of the audible signaling appliances such as bells or horns in the system sounding an alert signal. The alert signals must be of a different signal (e.g. a chime) than the alarm signals or any other sound used and transmitted in a building and may be different in number and in location. The audible signal applicances such as bells or horns used in this system may be used to sound both the alert and alarm signals. Separate appliances may, however, be used. If the alert signal is not acknowledged within five minutes the system will begin to sound an alarm signal. ABC85 3.2.4.13(2)

In a two stage system each manually actuated signalling box must be equipped so that a key or similar device can initiate a general alarm. After operation of the general alarm removal of the key must not deactivate the alarm.

This type of system signals a response to a fire condition in two stages - first an alert signal and then a general alarm signal. The system must be installed in Group B occupancies (Institutional) except they are not permitted in Group B, Division 1 with an occupant load of less than 10. In addition two stage fire alarm systems are not permitted in group F Division 1, High Hazard Industrial Occupancies. Either single or two stage systems are allowed in children's custodial homes, convalescent homes, day care centres and orphanages in buildings less than four storeys in building height. The reason for installing a two stage system in the majority of Group B occupancies is to avoid the unnecessary evacuation of patients or restrained persons when it is not necessary for their safety. The alert signal sounds to warn the staff that a fire condition may exist. The staff will then search the zone of origin to determine whether or not a fire condition does exist. If so, they will manually sound the alarm signal on a key operated manual pull station by using the key provided, or the system will automatically sound the alarm signal if the alert signal is not acknowledged (silenced) within five minutes. ABC85 3.2.4.3.(1)(b) ABC85 3.2.4.4.(2)

A fire alarm system is defined in CAN4-S524 as "a combination of devices designed to warn the building occupants of an emergency condition".

A fire alarm system must consist of at least the following interconnected devices: a control unit, manually actuated signalling boxes and audible signal appliances. This would be a very basic system. S524 3.1.1.

A fire alarm system may also include devices such as fire detectors, visual signal appliances, annunciators, emergency telephones and others. The addition of these devices can change a fire alarm system from a very basic manually operated system to a fully automatic one that features automatic operation as well as manual operation. S524 3.1.2.

A fire alarm system must be made up of the following basic components in order to satisfy the definition. It must have a control unit. This is a panel in which are mounted various electrical devices and interconnected wiring to control the operation of the system. Among other functions it may provide power to the system, receive signals from the alarm initiating devices, transmit signals and operate the audible devices. It must also provide electrical supervision as required for the system. One might refer to it as the nerve center of the system.

A fire alarm system must also have alarm initiating devices. These may be manual or automatic. The manual alarm initiating devices are commonly referred to as manually actuated signalling boxes, manual pull stations, break glass stations or pull boxes. They are manually operated switches that, when activated, cause alarm devices to sound throughout the building.

The third basic component is an alarm device, e.g., a bell or horn which is called an audible signal appliance. This sounds throughout the building to warn the occupants of a fire condition to permit them to evacuate the building.

Where a fire alarm system is required and a two stage system is installed, it must be designed to notify the fire department that an alert signal has been initiated. If a system is required and a single stage system is provided notification to the fire department is required when an alarm signal is initiated if the building is classified as: ABC85 3.2.4.7.(2)

i. Group A (Assembly) occupancy with an occupant load of more than 300;

ii. Group B (Institutional) occupancy (except for day care centres);

iii. Group F, Division 1 (High hazard industrial) occupancy; or

iv. a High Building under Subsection 3.2.6. of the Alberta Building Code. ABC85 3.2.4.7.(1)

For single stage systems not required to directly transmit a signal a notice must be posted at each manually actuated signaling box, i.e., pull station, requesting that the fire department be notified and including the telephone number of that department. ABC85 3.2.4.7.(5)

When notification is required, signals are to be sent to the fire department by the municipal fire alarm system, an independent central station conforming to NFPA-71, "Installation, Maintenance, and Use of Central Station Signalling Systems", or a proprietary control centre conforming to NFPA-72D, "Installation, Maintenance, and Use of Proprietary Protective Signalling Systems". If these are not available then an independent system such as a telephone line may be used to transmit the signal to the fire department. ABC85 3.2.4.7.(3) ABC85 3.2.4.7.(4)

The means of signal transmission are described as:

i. municipal fire alarm system - this type of system is not very common anymore.

ii. central station - usually a commercial company that sells its services to a number of building owners or operators. The company maintains a continuously manned office that receives signals from the various fire alarm systems. These signals are monitored and relayed to the fire department.

iii. proprietary control centre - similar to a central station but it is operated by the building owner or tenant and is generally within the building that is under control or in a location within a group of buildings under common ownership.

D. System Function

1. Zone Coding

Either single or two stage systems may be zone coded so that the alert or alarm signal also provides a means of identifying the zone in the system where the alarm initiating device has been activated. If a system is zone coded the coded alert or alarm signal is repeated in its entirety at least four times before a continuous alert or alarm signal begins. ABC85 3.2.4.4.(3)

If a second alarm initiating device is operated in a zone different from the one where the first initiating device is located the coded alert or alarm signal for the first zone must be completed before the coded alert or alarm signal for the second zone is repeated at least four times. ABC85 3.2.4.4.(4)

See D4. "Annunciators and Zone Indication" following for a discussion of zone requirements.

2. Silencing of Alarms

Required fire alarm systems must be designed so that once an alarm signal is activated it cannot be silenced automatically for at least five minutes in buildings which are not required to be equipped with an annunciator and twenty minutes for all other buildings. ABC85 3.2.4.6.(1)

A system cannot have manual silencing switches other than those installed inside the fire alarm control unit. This is to prevent easy access to silencing switches so that the alert or alarm signals will not be shut off until trained personnel have ascertained that no emergency exists. However, if there is a voice communication system incorporated in the fire alarm system there must be provision for silencing the alarm signal in a single stage system or for silencing the alert and alarm signals in a two stage system. In a single stage system this cannot occur until the alarm signal has sounded for at least one minute. In a two stage system the alert signal must have sounded for at least one minute before being interrupted for voice communication. ABC85 3.2.4.6.(2) ABC85 3.2.4.16.(2) & (3)

3. Signals to Fire Department

There are certain fire alarm installations that must have the capability to transmit a signal to the fire department. If special life threatening dangers or special fire hazards are involved the fire department must be notified as soon as the fire is detected.

Activation of each waterflow detection device in a sprinkler system is to be indicated separately on the fire alarm system annunciator. The annunciator must also indicate a trouble signal when any of the following occur in the sprinkler system: ABC85 3.2.4.11.(4)

i. movement of a control valve handle;

ii. loss of excess water pressure required to prevent false alarms in a wet pipe system;

iii. loss of air pressure in a dry pipe system;

iv. loss of air pressure in a pressure tank;

v. a significant change in water level in any water storage container used for firefighting purposes;

vi. loss of electrical power to any automatically starting electrical fire pump; or

vii. a temperature approaching the freezing point in any dry pipe valve enclosure or water storage container used for firefighting purposes. ABC85 3.2.4.11.(5) 3.2.5.5.(7)

If a trouble signal due to any of the items (i) through (vii) is received at the annunciator a signal shall activate a bell on the exterior of the building and shall be sent to the fire department or another acceptable location. ABC85 3.2.5.5.(8)

If a fire alarm system is required to have an annunciator all valves controlling water supplies in a standpipe and hose system, except hose valves, must transmit a trouble signal to the annunciator when a valve handle is moved. ABC85 3.2.5.4.(11)

In Group B, Division 2 (Institutional - Hospitals and Nursing Homes) occupancy each sleeping room smoke detector must be individually annunciated on a panel within, or in close proximity to, the zone established on the floor. Only the initiating zone, not the individual room, must be annunciated on the main building annunciator. The individual local annunciators need not be interconnected. The usual location for a local annunciator serving patients' bedrooms is at a nursing station. ABC85 3.2.4.10.(8)

Supplementary annunciators may be installed if the owner wishes.

5. <u>Electrical Supervision</u>

Electrical supervision must be provided for required fire alarm systems. This is a method of detecting a fault condition that would interfere with the operation of a circuit in the fire alarm system. ABC85 3.2.4.8.(4)

iv. independently owned system - this is commonly the telephone company who install an automatic dialer in the protected premises.

4. Annunciators and Zone Indication

An annunciator is a device that visually indicates the zone of origin of a signal received from the fire alarm system. This information assists the firefighters who respond to an alarm. It allows them to proceed directly to the area where the fire emergency has been reported. It helps saves time and energy which could otherwise be wasted searching through the entire building, which may be smoke filled, to locate the seat of the fire.

The annunciator must be located near a principal building entrance that faces a street or an access route for fire department vehicles. This location should be at the entrance to the building that the firefighters would first approach, either by design or prior agreement. ABC85 3.2.4.8.(1)

In two stage systems supplementary annunciators may be required at staff work stations.

Annunciators must be installed in all buildings that require fire alarm systems except those that do not require more than one zone indicator. ABC85 3.2.4.8.(2)

Separate zones must be established in a building and indicated on the annunciator:

i. in each floor area so that the area of coverage for each zone does not exceed 2000 square meters;

ii. in each fire compartment required to be separated by vertical fire separations having a fire-resistance rating of at least two hours, other than dwelling units;

iii. in each shaft required to be equipped with fire detectors; and

iv. in each air handling system required to be equipped with smoke detectors. ABC85 3.2.4.8.(1)

Note that these requirements in the Alberta Building Code 1985 are somewhat different from those in CAN4-S524, Sentence 4.6.5. The provisions of the Alberta Building Code govern.

If a sprinkler system is used in lieu of heat detectors (see E.2. "Heat Detectors" on page 21) the requirements for zone indication in (i) and (ii) above are waived provided that the activation of the alarm initiating devices is indicated on the annunciator in conformance with the zone indication requirements for the sprinkler system as specified in NFPA-13. ABC85 3.2.4.8.(3)

Only authorized personnel are to be allowed to operate any switch that will silence a trouble signal. S524 3.3.3.6

An annunciator is not required for fire alarm systems that consist of only one zone. In these cases remote audible and visual trouble signals must be located in a common area that is normally occupied by people when the building is in use. This remote trouble signal must also be permanently identified by the words "FIRE ALARM TROUBLE SIGNAL". ABC 3.2.4.8.(2) S524 3.3.3.7

Electrical supervision is required for the following system components and wiring thereto:

i. manually actuated signaling boxes;

ii. fire detectors;

iii. audible signal appliances such as horns or bells;

iv. visual signal appliances;

v. emergency telephone and communication equipment;

vi. main and standby power supplies; and

vii. annunciators. S524 3.3.1.2

viii. audible signal appliances with voice reproduction capability. S524 3.3.1.4

Supervised components in a system must be wired into the circuit in such a manner that disconnecting or removing them causes a trouble signal to be initiated. S524 3.1.13

Open circuits or ground faults in a circuit of a fire alarm system must not interfere with the operation of other circuits of the system and must initiate a trouble signal. S524 3.3.1.3

When a central alarm and control facility is required, the required electrical supervision is to be annunciated at the central facility. S524 3.3.1.5

Where they are needed to control electrical supervision current, end-of-line devices are to be installed beyond the last device in circuits for manually actuated signalling boxes, fire detectors and audible signal appliances. S524 3.3.2.1

6. Trouble Signals

Any fault detected by the supervisory circuit must operate both an audible and a visual trouble signal. These are to be located at the control unit and at each annunciator in the fire alarm system. When operated, the audible trouble signal must sound continuously and its sound must be distinct from the sounds of the alarm and alert signals. When any manually actuated signalling box or fire detector operates in the fire alarm system, it must not cause the trouble signal to be activated. S524 3.3.3.1 S524 3.3.3.2 S524 3.3.3.3

Where it is required to have remote audible and visual trouble signals in addition to those at the control unit and at the annunciators, they must be permanently identified by the wording "FIRE ALARM TROUBLE SIGNAL". Also, the remote trouble signal circuits must be designed so that any faults in them will not prevent the trouble signal in the control unit from being operated. S524 3.3.3.5 S524 3.3.3.4

3. Smoke Detectors

If a fire alarm system is required smoke detectors must be installed as follows:

MAJOR OCCUPANCY	LOCATIONS FOR SMOKE DETECTOR
A-1	corridors
B	sleeping rooms, corridors
C	public corridors
ALL	exit stair shafts

ABC85 3.2.4.10.(4)

In hospitals and nursing homes visual signals from smoke detectors in patients bedrooms must be provided so that the staff can readily identify the room where the alarm originated. The visual signals are to be located either above the bedroom door or at the nursing station if the door is not visible from the station. ABC85 3.3.3.7

Smoke detectors must also be provided in transformer vaults required by the Electrical Protection Act in buildings which require a sprinkler system when the sprinkler system does not service the vault. ABC85 3.5.2.8.(2)

4. Duct Type Smoke Detectors

Where an air handling system serves more than:

(a) one storey;

(b) one suite in a storey;

(c) one required zone in floor areas of unsprinklered hospitals and nursing homes; or

(d) one required fire compartment in sprinklered hospitals and nursing homes;

duct type smoke detectors are to be provided in every recirculating air handling system so that a signal from the detector will shut down the fans to prevent the circulation of smoke. ABC85 3.2.4.10.(5) 9.10.17.7.

Duct-type smoke detectors must also be installed in the main supply duct of every corridor and stairwell pressurization

E. System Components

1. Fire Detectors

Fire detectors are the sensing and initiating devices in a fire alarm system. Heat, smoke and flame detectors are different types of fire detectors. If fire detectors are required, they are to be connected to the fire alarm system. ABC85 3.2.4.10.(1)

When a fire alarm system is required, fire detectors must be installed in:

i. storage rooms not within dwelling units;

ii. service rooms not within dwelling units;

iii. janitors' closets;

iv. elevator and dumbwaiter shafts; and

v. rooms where hazardous products are to be used or stored. ABC85 3.2.4.10.(2) 9.10.17.5.

Fire detectors are not required in a storage room less than one square meter in area unless the room is a janitors' closet or the room is used for the storage of hazardous substances. Clothes closets 800 mm or less in depth are not considered as storage rooms. ABC85 3.2.4.10.(6) ABC85 3.2.4.10.(7)

2. Heat Detectors

When a fire alarm system is required heat detectors must be installed as follows:

MAJOR OCCUPANCY	LOCATIONS FOR HEAT DETECTORS
A-1; B	every room except sleeping rooms and washrooms in patients' bedrooms
C-over 3 storeys in building height	every suite and every room not located within a suite

ABC85 3.2.4.10(3)

Required heat detectors may be omitted if an automatic sprinkler system conforming to code requirements is installed. The sprinkler system must have water flow detecting devices which serve an area on each storey within the area limits given in NFPA-13, "Installation of Sprinkler Systems". These waterflow detecting devices must be connected so that they initiate an alert signal or an alarm signal on a fire alarm system. Required annunciation criteria for the sprinkler system are given in section D4, "Annunciators and Zone Indication". It is the water flow detecting device that is the concern of the person doing the design verification (the adequacy of the sprinkler system itself is by the mechanical designer). ABC85 3.2.4.11.(1) ABC85 3.2.4.11.(2) ABC85 3.2.4.11.(3)

7. Signal Appliances

(a) Audible

ABC85 3.2.4.14.(1)

Signals from audible signal appliances must be heard distinctly throughout the floor area in which they are installed. The alert and alarm signals must be readily distinguishable from each other and from any other signal that might be heard in the building. S524 3.1.5. ABC85 3.2.4.13.(1) S524 3.1.7

In a two stage system the same audible signal appliances may be used to sound the alert signals and the alarm signals. (See section II C3 page 14 for discussion.) ABC85 3.2.4.13.(2)

If audible signal devices with voice reproduction capabilities are intended for use other than in fire emergencies then they must be installed so that alert signals and alarm signals take priority over all other signals. ABC85 3.2.4.13.(3) S524 3.1.8

Audible signal appliances must be installed in each corridor of a building and everywhere else where they are required for proper coverage. They must be loud enough to be heard and recognized by all the people within the area served. If a fire alarm system is required to have voice communication capability each signalling zone must contain at least two audible signal appliances that are capable of voice reproduction. No zone can include more than one floor. Each exit stairway must be a separate signalling zone. S524 4.4

CAN4-S524 suggests sound pressure levels for each zone in a building. The recommendations are:

i. for alarm or alert signals at least 15 dB above the equivalent sound level or 5 dB above the maximum sound level which has a duration of at least 60 seconds, whichever is greater, but not less than 90 dBA. Measurements of sound level are to be taken at 1500 mm above the floor;

ii. for voice communication at least 9 dB above the equivalent sound level or 3 dB above the maximum sound level which has a duration of at least 60 seconds, whichever is greater, but not less than 85 dBA. Measurements of sound level are to be taken at 1500 mm above the floor; and

iii. for the purpose of this clause the equivalent sound level is the averaged A-weighted sound pressure level measured over a 24 hour period under normal occupancy conditions. S524 4.4.4

system or make-up air unit. A signal from these must shut down fans in the system or unit. ABC85 3.2.4.10.(9) 9.10.17.12.

It is a good idea for the electrical designer to sit down with the person doing the mechanical design to learn how the system functions so that these duct detectors will be properly located at the design stage.

5. Smoke Alarms

Note: A smoke alarm is not considered to be part of a fire alarm system. See definition also.

A smoke alarm is a combination of a smoke detector and an audible alarm device. It is designed to sound an alarm in the room or suite in which it is located when smoke is detected in the room or suite.

The purpose of a smoke alarm is to warn people of the presence of smoke in their dwelling unit especially if they are sleeping. Therefore, with one exception smoke alarms must be installed in every dwelling unit and in every sleeping room that is not in a dwelling unit. The exception is sleeping rooms in an institutional occupancy that are equipped with a fire alarm system because they are required to have smoke detectors connected to the fire alarm system. ABC85 3.2.4.15.(1) 9.10.18.1.

Where more than one smoke alarm is required in a dwelling unit they are to be wired so that if one alarm is activated all the alarms in that dwelling unit will sound. ABC85 3.2.4.15.(5) 9.10.18.5.(1)

When new sleeping space is developed in an existing dwelling unit, it is not necessary to connect new required smoke alarm to existing smoke alarms. However, if more than one new smoke alarm is required, all the new smoke alarms must be connected to each other. ABC85 9.10.18.5.(2)

6. Manually Actuated Signalling Boxes

A manually actuated signalling box (pull station) must be installed near every required exit. ABC85 3.2.4.12.

Note that this requirement is less stringent than S524 4.3.1 & 4.3.2. The Alberta Building Code governs.

Pull stations are not to be installed within a stairway enclosure. S524 4.3.4

Pull stations are to be installed so that no person in an open floor area has to travel more than 60 meters to reach the nearest pull station. S524 4.3.3

In a two stage fire alarm system all pull stations must operate in the same manner and with a common key. S524 4.3.6

zones while still maintaining an alert signal or an alarm signal to the other zones in the building. ABC85 3.2.4.16.(4)

The two way communication system is to include emergency telephones located in each floor area near exit stair shafts. ABC85 3.2.4.16.(5)

The voice communication system must be connected with the fire alarm system so that it will not only operate correctly but it will also not prevent the fire alarm system from operating properly. S524 3.1.4

If a system which has voice communication capabilities is to be used other than for emergencies the audible signal devices must be installed and wired in such a manner that the alert and alarm signals will take priority over any other signal. S524 3.1.6 S524 3.1.8 The alert and alarm signals must not be voice commands, however, they may be supplemented by a voice command. S524 3.1.9

Also, if a voice alarm type fire alarm system control is used for other purposes such as background music or general paging, the fault detection and indication for the circuits must be maintained at all times. Further, a fault on a general use extended circuit, or a failure of a device connected to the circuit, shall not interfere with the performance of the fire alarm system.

The emergency power supply for voice communication systems must be capable of full operation immediately upon the failure of the normal source of power supply. ABC85 3.2.6.10.(1)

9. Emergency Telephones

Where two way communication is required, it must be provided between emergency telephones which are located within 6 meters of an exit in each floor area and at the central alarm and control facility. When a handset is lifted from its cradle an automatic audible and visual signal must register at the central alarm and control facility. S524 4.7.1. S524 4.7.3

Emergency telephones must not be located in stairways. They must be located so that at least one emergency telephone is accessible at all times. Their location and method of use must be clearly identified. Emergency telephones must be located in a locked enclosure with a break glass. Methods other than a break glass may be used subject to acceptance by the authority having jurisdiction. S524 4.7.4 S524 4.7.2 S524 4.7.5

10. Central Alarm and Control Facilities

For high buildings as defined in Section 3.2.6 of the Alberta Building Code 1985 a central alarm and control facility must be provided on the street entrance floor in a place readily accessible to firefighters as they enter the building. This facility should be designed so that it will properly perform

(b) Visual

Visual signals are normally required in addition to audible signal appliances if people with hearing impairments could be present in the space at times when there are no people with normal hearing present to communicate the existence of an emergency. They would also be installed in industrial premises where the normal noise level would overpower the sound of audible signal appliances. ABC85 3.2.4.13.(4)

When required, they must be installed in all appropriate rooms and areas. They must be installed so that at least one visual signal appliance will be visible to each person in the room or area. ABC85 3.2.4.14.(2) S524 4.5.1

8. Voice Communication Systems

There are two types of buildings which are classified as high buildings in the Alberta Building Code 1985 that must have a voice communication system installed as part of the fire alarm system. The two types are:

i. those buildings that have a height greater than 36 meters between grade and the floor level of the top storey; and

ii. those buildings that have an institutional occupancy (Group B) located above the third storey intended for patients in bed or persons who, because of age or health, require special care or treatment. ABC85 3.2.6.8.

The fire alarm systems in these buildings must have some means at the central alarm and control facility to control the voice communication system and be able to send messages to all loudspeakers at the same time and to individual floor areas and exit stairwells. ABC85 3.2.6.7.(2) (a)

The voice system must be a two way communication system to each floor area with connections to the central alarm and control facility and to the mechanical control center. There must be loudspeakers which are designed and located so that they will be heard in all parts of the building except in elevator cars. These loudspeakers are to be operated from the central alarm and control facility. ABC85 3.2.4.16.(1) (a) ABC85 3.2.4.16.(1) (b)

The voice system must include provision to silence the fire alarm devices when the loudspeakers are in use. This over-ride is only to be effective after the fire alarm signaling devices have first operated for at least one minute. ABC85 3.2.4.16.(2) & (3)

The voice communication system must be designed so that voice instructions can be transmitted selectively to any zone or

interface between these devices and the fire alarm system is usually a relay.

Hold-open devices are permitted on doors in required fire separations other than exit doors in buildings greater than three storeys in building height and doors on vestibules required in storage garages. A smoke detector must be installed which, when initiated, will cause the hold-open device to release the door. For doors opening into public corridors and egress doors from rooms or suites which are separated from the remainder of the floor area by a fire separation having a fire-resistance rating of at least 45 minutes a hold-open device may be released by a sprinkler system or heat actuated device provided that: ABC85 3.1.6.8.(3)

i. the door is not a required exit;

ii. the door does not serve a Group A, B, or C occupancy; and

iii the door is not required to function as part of a smoke control system.

Also, a hold-open device must release on a signal from the building fire alarm system. This requirement does not apply to a hold-open device on a door located between a corridor and an adjacent patients' bedroom in a hospital or a nursing home nor does it apply to a hold-open device that is designed to be released by a heat actuated device as described above. ABC85 3.1.6.8(3)& (4)

12. Wiring

All of the field wiring of a fire alarm system must be installed in accordance with the provisions of the Canadian Electrical Code, Part I, Section 32 as well as the General Sections of the Canadian Electrical Code and the Electrical Protection Branch Quarterly Bulletins. The fire alarm system must be designed and installed so that it will be capable of performing its intended function at any supply voltage between 85% and 110% of the rated voltage. The voltage drop on any given circuit must not prevent the proper operation of that circuit and the voltage drop must be in accordance with the manufacturer's installation instructions. S524 3.4.1.1 S524 3.1.10 S524 3.4.2.1

Electrical work must be carried out in accordance with the Certification of Electrical Workers Regulation under the provisions of the Electrical Protection Act.

Every circuit in a fire alarm system must be installed so that any open circuits or ground faults that might occur in a circuit will not interfere with the operation of any other circuit in the system. S524 3.1.14

with the background noise that will be present during a fire emergency. ABC85 3.2.6.7(1)

The central alarm and control facility is to include:

i. means to control the voice communication system and provisions to send messages to all loudspeakers simultaneously and to individual floor areas and exit stairwells;

ii. audible and visual means to indicate alert and alarm signals and a switch to silence the audible portion of these signals together with a visual indication that the audible portion has been silenced;

iii. an annunciator;

iv. means to transmit alert signals and alarm signals to the fire department;

v. means to release hold open devices on doors to vestibules;

vi. means to manually actuate alarm signals in the building and to silence these signals in accordance with the requirements outlined in Section E8, "Voice Communication Systems"; and

vii. means to actuate auxiliary equipment or means to communicate with a continually manned auxiliary equipment control centre. ABC85 3.2.6.7.(2)

11. Ancillary Devices

These are devices that are actuated by fire alarm system but which are not required by code to be part of the fire alarm system. Ancillary devices are allowed to be controlled by the fire alarm system subject to the following:

i. the power required to operate the devices cannot be taken from the fire alarm circuit;

ii. the devices must not interfere with the operation of the fire alarm system; and S524 3.1.15

iii. the ancillary devices must be installed in such a manner that any open circuits or ground faults in these circuits will not interfere with the operation of the fire alarm system. S524 3.1.16

Typical ancillary devices are door hold-open devices, smoke exhaust fans, fire damper motors and automatic doors. The

The main power supply must be able to supply enough power to operate all of the audible and visual signal appliances under a general alarm condition for an indefinite period of time. S524 3.2.2.9

The voltage must be maintained within the limits that are specified in CSA-C235, "Preferred Voltage Levels for AC Systems, 0 to 50,000 Volts". For a system design voltage of 120 volts, single phase, the limits for normal operating conditions are from 108 volts to 125 volts. Voltages are to be measured at the point of connection of the branch circuit supplying the fire alarm system. S524 3.2.2.11

2. Emergency Power Supply

(a) General

An emergency power supply must be provided for all required fire alarm systems. ABC85 3.2.4.9.(1)

Note that this requirement is different than S524. The Alberta Building Code 1985 governs.

The supply shall be from a generator, batteries or a combination of both. Emergency power systems must be installed in accordance with CSA-C282, "Emergency Electrical Power Supply for Buildings" or, in the case of hospitals or nursing homes, in accordance with CSA-Z32.4, "Essential Electrical Systems for Hospitals". They shall be designed so that there is an automatic transfer of power within 15 seconds in the event of a failure of the normal power source. However, in high buildings that require a voice communication system the emergency power supply for the voice communication system must operate fully immediately on the failure of the normal power source. ABC85 3.2.4.9.(2) ABC85 3.2.7.4.(1) ABC85 3.2.7.4.(2) S524 3.2.2.4 ABC85 3.2.6.10.(1)

In the case of hospitals and nursing homes the emergency supply must be from a generator set driven by a prime mover and located on the hospital premises-batteries alone, are not allowed. CSA-Z32.4 5.2.1.

The emergency power supply must be capable of providing one rated load cycle which consists of supervisory power for at least 24 hours and emergency power under full load for at least:

i. 2 hours for high buildings;

ii. 1 hour for buildings under Group B (Institutional) that are not classified as high buildings;

iii. 5 minutes for buildings that are not required to have an annunciator; and

The field wiring of a fire alarm system must test free of ground faults except for those parts of circuits or equipment which are intentionally and permanently grounded. Except for the control unit a fire alarm system must be designed so that it does not depend on the effectiveness of any ground connection for its operation.

All electrical devices and control equipment in the fire alarm system except batteries must be tested by a recognized testing agency such as ULC or CSA for their intended use and must bear the required approval marking. Every device must be compatible in all respects with the fire alarm system in which it is installed. S524 3.1.12 S524 3.1.11

Conductors installed in service spaces containing combustible materials in high buildings must be separated from the rest of the space by a fire separation having a fire resistance rating of at least one hour or must be protected against fire exposure from the source of power supply to the end of the branch circuits serving the equipment to ensure continued operation for at least one hour. ABC85 3.2.6.9.(1)

In high buildings where the central alarm and control facility and the fire alarm control unit are in different fire compartments, the electrical conductors connecting the fire alarm control unit to the central alarm and control facility must be protected against fire exposure to ensure continued operation for a period of at least one hour. ABC85 3.2.6.9.(2)

F. Power Supply

1. Main Power Supply

The electrical power supply to operate a fire alarm system is to be from a public electric utility or other source acceptable to the authority having jurisdiction. The provisions of the Canadian Electrical Code, General Sections and as adopted in Alberta and the Electrical Protection Branch Quarterly Bulletins Part I, Section 32 govern the installation of all power supply equipment and wiring. S524 3.2.1.2 S524 3.2.1.1

The conductors from the power supply to the fire alarm system must be connected to the load side of the main electrical service to the building. There must be a disconnecting means located as near as possible to the electrical service panel. S524 3.2.2.2 S524 3.2.2.3

This branch circuit shall not be used for any other purpose than to provide power to the fire alarm systems. S524 3.2.2.8

Each ungrounded conductor is to be protected with an overcurrent protective device that has suitable current carrying capacity that is at least 150% of the rating of the system. This device must be able to interrupt the maximum short circuit current to which it may be subjected. S524 3.2.2.12

The branch circuits from the standby power supply to the fire alarm system shall be used for no other purpose than to provide power to the fire alarm system. S524 3.2.2.8

(b) Generator Standby Power Supply

If an engine driven generator is the standby power supply it must be installed according to the installation requirements of CSA-C282, "Emergency Electrical Power Supply for Buildings". S524 3.2.3.1

The engine cranking battery, the control circuit conductors and those power circuit conductors used to start the standby generator must be electrically supervised in accordance with CSA-C282. If there is any wiring fault or engine cranking battery condition that would not allow the delivery of standby power when required the specific fault that caused the malfunction must be indicated. The trouble signals from the engine driven generator must automatically be transmitted to the fire alarm system control unit. S524 3.2.2.13 S524 3.2.3.2

There must be enough fuel available for twelve hours operation of the engine driven generator if a reliable fuel supply source is available at any time on 2 hours notice. If a fuel source is not readily available or if special arrangements must be made for refueling then a fuel supply sufficient for 24 hours of operation at full load must be provided. S524 3.2.3.3

(c) Battery Standby Power Supply

When batteries are used as the standby power supply, they must have the capacity to supply power to the fire alarm system for one rated load cycle when there is no charger connected.

A rated load cycle is defined in Section II F2a page 30.

The batteries must be the rechargeable type with the charger connected to the main power supply. They must be vented so that no damage to adjacent equipment will occur if the electrolyte should accidentally spray. The batteries must be mounted within a ventilated enclosure located to protect the batteries and associated equipment under rated operating conditions. S524 3.2.5.1 S524 3.2.4.3 S524 3.2.4.1

iv. 30 minutes for all other buildings. ABC85 3.2.4.9.(3)

Note that these requirements in the Alberta Building Code 1985 are somewhat different from those in CAN4-S524, Sentence 3.2.2.10. The provisions of the Alberta Building Code govern.

Additionally, for a fire alarm system with voice communication capability the standby power supply shall be capable of providing thirty minutes of continuous voice communication after having provided power for electrical supervision for the previous 24 hour period. S524 3.2.2.10

The times indicated are for the durations for which emergency power must be available for the building under fire emergency conditions. Additional fuel for generators or additional battery capacity is required to handle normal testing of the equipment, as indicated in the Alberta Fire Code. If the operation of emergency generators or batteries is anticipated for other than fire emergency conditions, such as power failures, fuel supplies or battery capacity must be increased to compensate for such use.

The voltage must be maintained within the limits that are specified in CSA-C235, "Preferred Voltage Levels for AC Systems, 0 to 50,000 Volts". For a system design voltage of 120 volts, single phase, the limits for normal operating conditions are from 108 volts to 125 volts.

Voltages are to be measured at the point of connection of the branch circuit supplying the fire alarm system. S524 3.2.2.11

When the main power supply is restored the fire alarm system is to be automatically switched back from the standby power supply within 5 minutes. If the standby power supply fails within this 5 minutes the fire alarm system is to be switched back to the main power supply instantaneously. S524 3.2.2.5

The conductors from the standby power supply must be connected to the fire alarm system through a disconnect device and through an overcurrent device. The disconnecting device must be located as close as possible to the standby power supply. If the standby power supply is by means of batteries the disconnect device is not required if the batteries are located within 3600 mm of the fire alarm control unit. S524 3.2.2.6

A disconnect device used with a generator supplying standby power must be equipped with a method of locking the device to prevent tampering. S524 3.2.2.7

When the circuit does not terminate in the control unit, locate in a separate box which is normally not more than 1800 mm above finished floor and is positioned beyond the last manually actuated signalling box, fire detector, or audible or visual signal appliance. The end of line device shall be located in a separate box that is clearly identified, mounted on or below the ceiling, and accessible without the use of platforms or scaffolding. S524 3.3.2.1 QBOCT83

7. Heat Detectors

(a) General

The sensitivity of heat detectors is expressed in terms of the maximum allowable distance between detectors when mounted on a smooth ceiling and subjected to a standard fire test. The allowable separation for any given make and model may be found in ULC, "List of Equipment and Materials", Volume 1.

For the purpose of determining the number of heat detectors and their spacing and location two dimensions are used:

"D" - the horizontal distance between two adjacent heat detectors in meters (m)
"W" - the horizontal distance between a heat detector and an adjacent wall, partition or boundary of a separate area in meters (m) (W is one half of D)

(b) Number of Detectors

To calculate how many heat detectors are required to protect a given area the area is divided by D squared as in i. below. If the area to be protected is a concealed space then the area is to be divided by 2.5 times D squared as in ii. below. It is important that the correct D value for the selected detector be used in the calculation of the number of heat detectors to be installed. S524 4.8.3.1 S524 4.8.3.2.

i. Normal

$$\text{required number} = \frac{\text{Area}}{D^2}$$

ii. Concealed Space

$$\text{required number} = \frac{\text{Area}}{2.5D^2}$$

(c) Mounting

Heat detectors are to be surface mounted with the base

G. Installation Criteria

1. General

Locate and mount all devices so that vibration and jarring will not cause accidental operation or malfunction. It is also imperative to mount all devices so that there is sufficient clear space to allow their proper function and to allow for testing and servicing as required. — S524 3.1.20

2. Control Units

Mount with the top of the unit no more than 2400 mm above finished floor level. — S524 4.2.2

3. Annunciators

Install on, or in, a permanent wall or partition with the top no more than 2400 mm above finished floor level. — S524 4.6.3 & 4.6.4

4. Smoke Alarms

Install within dwelling units between each sleeping area and the remainder of the dwelling unit and, where the sleeping areas are served by hallways, install in the hallways. If there is more than one smoke alarm they must be interconnected. — ABC85 3.2.4.15.(2) 9.10.18.2. 3.2.4.15.(5) 9.10.18.5.(1)

Install on or near the ceiling. — ABC85 3.2.4.15.(3) 9.10.18.3

Install with permanent connections to an electrical circuit and with no disconnect switches between the overcurrent devices and the smoke alarm. If there is no electrical power supply in the building the smoke alarms may be battery operated. — ABC85 3.2.4.15.(4) 9.10.18.4.

When the development of space for sleeping use in an existing dwelling unit results in the need to install a smoke alarm, that alarm does not need to be interconnected with existing smoke alarms. However, if more than one new smoke alarm is required all the new smoke alarms must be interconnected. — ABC85 9.10.18.5.(2)

Instructions necessary for the care and maintenance of smoke alarms must be posted so that they are readily accessible to the occupants for reference. — ABC85 9.10.18.6

5. Manually Actuated Signalling Boxes

Mount with the centre between 1350 mm and 1500 mm above finished floor level. — S524 4.3.5

6. End of Line Devices

When circuits terminate in the control unit, locate devices in the control unit.

If the bays in the preceding category are less than 2.25 square meters in area then the ceiling is to be considered as a smooth ceiling but the spacing of heat detectors must be reduced to D/2. S524 4.8.2.1C

If there is no installed ceiling the underside of the floor, roof, soffits, joists or other structure above the protected area shall be considered as a ceiling. S524 4.8.2.2

An open grid type ceiling shall not be considered as a ceiling. S524 4.8.2.3

11. Walls and Partitions

The spacing between the center of a heat detector and any wall, partition or boundary of a separate area cannot exceed W. S524 4.8.5.3

flush with the ceiling. If they are installed in surface mounted boxes so that they are not flush with the ceiling then the spacing of the heat detectors must be reduced to that specified for exposed joists and rafters (see section IIG7dvii on page 39). There must be a clear space around the detector for a radius of at least 600 mm. This clear space is to extend below and around the detector as well as on the ceiling. Detectors must not be mounted closer than 600 mm to an outlet of any air distribution system. If there is the possibility of a heat detector being damaged it must be protected. The method of protection must not interfere with its operation. S524 4.8.4

(d) Spacing of Heat Detectors

1. General

When mounted on ceilings with a height of 3 m or less, the distance between detectors must not be greater than the distance D for which the detector is rated. S524 4.8.5.1

When mounted on ceilings with a height of more than 3 m, the distance between detectors must not be greater than 75% of the distance allowed. S524 4.8.5.2

If an area is divided into sections by things such as walls, partitions or storage racks reaching to within 300 mm of the installed ceiling (or soffits or joists if there is no installed ceiling) then each section must be considered to be a separate area. S524 4.8.2.1A

If a ceiling is divided into bays formed by beams or some other construction features that project down more than 375 mm from the ceiling then each bay greater than 2.25 square meters in area must be considered as a separate area. S524 4.8.2.1B

v. Cupboards (Closets)

If the area of a cupboard does not exceed D squared and the length does not exceed 2 times D then only one heat detector is required and it should be installed at the center of the cupboard. S524 4.8.5.7

If the area of a cupboard exceeds D squared and the length exceeds 2 times D then two or more heat detectors must be installed and the spacings shall not exceed D and W. S524 4.8.5.8

vi. Corridors

If the width of a corridor is less than one half of D then the spacing between heat detectors cannot exceed 2 times D and in no case shall the spacing exceed 15 m. S524 4.8.5.9

iii. Flat Ceilings

The spacing between heat detectors on a flat ceiling shall not be more than D. S524 4.8.5.4

iv. Partial Ceilings (1.2 m or more wide)

If the partial ceiling is flat the spacing cannot exceed D. S524 4.8.5.5

If the partial ceiling is sloped heat detectors shall be located between 250 mm and 350 mm from the top of the slope and other detectors shall be spaced from the top row of detectors not more than D measured horizontally. S524 4.8.5.6

viii. Concealed Spaces

If a concealed space containing services is not more than 1800 mm in height and is isolated by fire separations then the heat detectors must be spaced no more than 2 times D apart but not more than 15 m. S524 4.8.5.12

If a concealed space is not more than 1800 mm in height and is not isolated by fire separations, but is constructed so that the lateral spread of gaseous products of combustion is not restricted, then the spacing shall not exceed 2 times D but not more than 15 m. S524 4.8.5.13

If the height of the concealed space exceeds 1800 mm then the space shall be treated as a room. S524 4.8.5.14

Where two corridors intersect, a heat detector must be installed at the center of the intersection. S524 4.8.5.10

vii. Exposed Joists and Rafters

If exposed joists and rafters are solid then the spacings of heat detectors shall not exceed one half of D or one half of W. S524 4.8.5.11

x. Openings Through Ceilings

If an opening in a ceiling is 0.09 square meters or more in area and the space immediately above the opening is not enclosed by fire resisting doors then heat detectors must be installed on the ceiling not more than one half of W horizontally from the opening.

In the case of a bank of elevators the detectors must be installed on the ceiling one half of W horizontally from the front of each enclosure door and in no case more than 2250 mm from the door. S524 4.8.5.17

xi. Doorways to an Unprotected Building

A heat detector is to be located on the ceiling of the protected area not more than one half of W horizontally from the center of each doorway. S524 4.8.5.18

ix. Special Roof or Ceiling Shapes

If roof or ceiling is saw-toothed, gabled or has any shape that allows hot gases to flow toward the highest part then the heat detectors must be installed with engineering input to establish air flow patterns, material likely to ignite, stratification expected and roof construction. S524 4.8.5.15

If a roof or ceiling of a monitor, turret or other upward projection is flat then heat detectors shall be spaced as for a flat ceiling. S524 4.8.5.16

Narrow Area Width, mm	Maximum Distance Between Smoke Detectors, Meters	Maximum Distance to End Wall, Meters
1500 or less	18	9
over 1500 not more than 3000	16.5	8.25
over 3000 not more than 4500	15	7.5
over 4500 not more than 6000	13.5	6.75
more than 6000	see preceding paragraph	

Smoke detectors are to be located on the ceiling not closer than 150 mm to the wall. In narrow locations where the width is 1.5 m or less a smoke detector may be located on the wall between 150 mm and 300 mm from the ceiling. S524 4.9.2.3

In locations provided with ceiling mounted air outlets or where open windows may cause drafts the smoke detectors must not be mounted near these air inlets. The smoke detectors must be located where the air flows toward the opening of a return air grille. This will ensure proper response to a smoke source within the protected space. S524 4.9.2.5

Where ceilings are constructed of solid beams or of solid joists that project down and form barriers to the flow of smoke, the smoke detectors are located as below. S524 4.9.2.4

JOIST OR BEAM		DETECTOR LOCATION
PROJECTION, mm	SPACING, meters	
less than 450	6 or less	- at bottom of beams - space as for narrow spaces
less than 450	more than 6	- on ceiling - space as for a flat ceiling
450 or more	6 or less	- on ceiling - space in each bay as for a narrow enclosed area
450 or more	more than 6	- on ceiling - space in each bay as for a flat ceiling

8. **Smoke Detectors - Spot Type**

Except for narrow enclosed areas the maximum area to be protected by one smoke detector must not exceed 83 square meters. It is not necessary to have a symmetrical spacing of smoke detectors in order to obtain the maximum advantage from normal air movement. However, the maximum spacing between detectors must not exceed 13.5 m and the maximum distance from any sidewall to a smoke detector must not be greater than 6.75 m. S524 4.9.2.1

The spacing of smoke detectors located in narrow areas such as hallways and corridors must be as shown in the table below. S524 4.9.2.2

Smoke detectors may be used in lieu of sprinklers in a vault provided the smoke detector is capable of activating the fire alarm system. ABC 3.5.2.8

Where door hold open devices are required to release upon a signal from a smoke detector, the detector shall be located in accordance with NFPA-80. See Appendix D at the end of this document for the diagrams showing locations and dimensions for detector locations. ABC 85 3.1.6.8.(4)

III VERIFICATION OF A FIRE ALARM SYSTEM

A. Introduction

When installation of a fire alarm system has been completed, it must be completely tested ("verified") to ensure that the system and each of its components functions as intended. The requirements of CAN4-S537, "Standard for Verification of Fire Alarm System Installation" apply.

For buildings which are required to be designed and to have construction review by professional architects and/or professional engineers the verification and documentation must be done under the direction of professionals who through training and experience are familiar with the installation and functional requirements of the system. For most buildings this will be the professional engineer responsible for the design of the fire alarm system. It may, however, be a different engineer if so desired by the owner. Using different engineers for the design and verification function may create confusion and lead to extra costs on the job-site. On completion, a verification document or letter must be signed and sealed by the engineer assuming responsibility for verification.

For buildings with no professional involvement the person responsible for the testing and documentation is to be a person who, by virtue of training and experience, is familiar with the installation and operation of the fire alarm system and its components.

The recommended procedure for these cases is:

- after the fire alarm system has been fully installed the installer shall perform all tests specified in CAN4-S537 - "Standards for Verification of Fire Alarm Systems" in the presence of the owner,

- the owner or his agent shall send a written statement to the building inspector that:
  - identifies the building;
  - lists the tests that were undertaken;
  - gives a description of the fire alarm system;
  - confirms that the fire alarm system is fully operational;
  - is signed by the installer;
  - is signed by the owner to confirm that he has witnessed the testing and understands the operation and maintenance requirements of the fire alarm system.

In any case the person doing the verification must not be employed by the installer of the system which is to be verified.

The person responsible for the building (or his designated agent) must be present during the testing. The installer and a representative of the manufacturer must also be present so that: S524 3.6.2.

9. **Duct Type Smoke Detectors**

These detectors are required in two places. One is to be placed in the return air duct at a point that is before any exhaust outlet from the building and before any fresh air intake that would dilute the return air. The second detector must be installed in the main air supply duct downstream from the filters and after the heat exchanger. Both detectors must be located so that they are easily accessible for service and maintenance. Smoke detectors should also be kept away from humidifiers to ensure their proper operation. S524 4.9.3.2 S524 4.9.3.3

10. **Audible Signal Appliances**

These are to be mounted with the center not less than 1800 mm above the finished floor. S524 4.4.2

Audible signal appliances with voice reproduction capability shall be mounted in accordance with the manufacturer's recommendations in enclosures that are intended and accepted for this purpose. S524 4.4.3

11. **Emergency Telephones**

These are to be located within 6000 mm of an exit and in approximately the same location on each floor area. The telephone must be mounted between 1350 mm and 1500 mm above the finished floor. S524 4.7.2

i. supervisory signals operate in response to open circuits, short circuits, ground faults and disconnection of plug-in components;

ii. terminations of conductors entering and leaving equipment have been made; and

iii. circuit polarities are in accordance with the system design, where applicable.

(b) Circuits Utilizing Power from the System

Tests are to be conducted to establish that the power supplied to any device is within its recommended operating range and that the required voltage levels are maintained and that the fusing is correct and not by-passed.

(c) Wiring Installation

Features of the wiring and installation which may affect the acceptable performance of the system are to be recorded as potential equipment malfunctions. This is notwithstanding the fact that the fire alarm system may perform acceptably when subjected to examination and test.

The wiring and installation is to conform to the requirements of Canadian Electrical Code, Part I, the Electrical Protection Branch Quarterly Bulletins and CAN4-S524, "Standard for the Installation of Fire Alarm Systems".

3. Equipment and Devices

(a) General

The following tests must be conducted, where applicable, on all installed equipment:

i. equipment is to be examined for any apparent damage or tampering that may interfere with its intended operation; and

ii. equipment with capability for field adjustment is to be tested to establish that it functions as intended under the conditions prevailing at its point of installation; and

iii. equipment is to be checked to ensure that it is installed for ease of operation, maintenance and proper operation.

i. the manufacturer can arrange for quick replacement of defective units and make minor adjustments of malfunctioning components in the control unit or the annunciator panel; and

ii. the installer can remove and replace wiring, disconnect units for testing and replace defective units. Electrical work must be carried out in compliance with the Certification of Electrical Workers Regulation. STANDATA 85DI005 QBAPR84 QBJUL85

B. Verification Procedures

1. General

The system must be fully operable before testing is started and the sequence of testing established to ensure that remedial and additional work that has to be done will not invalidate previous tests and inspections. S537 2.1.2

At the conclusion of the testing procedure the verification certificate confirms that the supply, installation and operation of the system conforms to the design and to requirements of the Alberta Building Code 1985, the Canadian Electrical Code, Part I and the Electrical Protection Branch Quarterly Bulletins. S537 2.1.1

A certificate of verification, signed and sealed by the professional responsible indicating that the system, as installed, has been verified is to be provided to the owner upon satisfactory completion of the verification and test program. A certificate of verification shall not be issued until all deficiencies noted during the verification procedure have been rectified. A copy of the verification and test report may be required by the authority having jurisdiction if requested. S537 2.1.3 ABC85 1.5.4.1.

A copy of the certificate of verification is to be attached to a complete and detailed description of the system and to a copy of the verification report. These must remain in the possession of the owner and be available in the event of future inspection of the fire alarm system. S537 2.1.4

The following requirements are from S537 and outline details of the procedures to be followed. A written report should be prepared and should include details of any problems encountered together with remedial measures that were taken.

2. Wiring

(a) Supervised Circuits

Every device is to be inspected and tested to demonstrate that disconnection of the device from the circuit or malfunction of the equipment or wiring activates the required supervisory signals. The inspection is to demonstrate that:

Battery	- charging system - proper circuiting through fuses - protection from damage - capability to provide power with charger disconnected for one rated load cycle as defined in section IIF2(a) on page 30.
Control Equipment	- visually and physically examine all cables, plug interconnections, plug-in circuit components, lamps, sockets and controls for proper mechanical and electrical function and, where applicable, electrical supervision - all field wiring is installed in a workmanlike manner and is terminated on a single conductor per terminal basis - all lamps and indicators for operation and function - all control unit functions are operational - simulate open and short circuits and ground faults on all relevant internal circuits to check supervisory response - test under open or ground fault conditions
Ancillary Equipment	- that any faults in ancillary equipment do not interfere with operation of the fire alarm system
Auxiliary Alarm System	- that it performs as intended

4. Labelling

A system verification label shall be attached to the main system control centre after inspection and acceptance of the entire system by the verification organization.

The label shall include the following information:

- identification of the individual and organization responsible for the verification
- date verification completed
- label serial number

(b) **Component Check List**

For individual components use the following check list.

COMPONENT	CHECK
Manually Actuated Signalling Boxes	- break glass or similar feature in place - operate each station
Heat Detectors - Resettable or self-restoring	- heat source used to indicate an alarm
Heat Detectors - Non-Resettable	- simulate electrical operation at wiring points adjacent to operating mechanism to initiate an alarm
Smoke Detectors - Area	- introduce real or artificial smoke into detecting chamber to initiate an alarm
Smoke Detectors - Duct	- sensitivity and air velocity at sampling devices under "balanced" air circulation.
Detectors - Other	- initiate alarm as recommended by the manufacturer. - record conditions which cause nuisance (false) alarms
Alarm Signals - Audible & Visual	- operate to check function - test on both main and standby power supplies with maximum load on system - record areas where alarm not heard
Annunciators & Recording Devices	- operate to test function - zone of each alarm initiating device is indicated correctly - legend is clearly visible - voltage is adequate - wiring connections done in workmanlike manner
Main Power Supply	- proper fusing - only one main disconnect means - adequacy for system - power for ancillary devices is taken from a source separate from the fire alarm system control unit power supply
Generator Standby Power	- proper transfer from main to standby - starting - voltage range

B. AUDIT PROCEDURES

1. General

Where suitable drawings of the existing fire alarm system are available, they provide a basis for the audit.

If drawings are not available the owner is to obtain a complete description of the system in plan or document form from the person doing the audit.

If a failure occurs in any of the following tests this will not necessarily imply that the system is not functional. It will, however, be incumbent upon the person performing the audit to inform the owner and the fire authority, by way of a written report, about the details of the failure.

Tests must be recorded and fully described. Failures must be recorded and the appropriate test repeated to ensure that satisfactory repairs or modifications have been made.

The following tests must be performed on all equipment:

i. examine all electrical connections to every device to ensure that supervisory circuits, where provided, function as intended;

ii. ensure that all conductors have been individually terminated in an approved manner;

iii. check all devices for tampering or damage that may affect their operation;

iv. check that circuit polarity requirements have been met;

v. test equipment with capability for field adjustment to ensure that the adjustment is compatible with the expected hazard conditions;

vi. operate every manual alarm station;

vii. activate every automatic device;

viii. ensure that every device is installed so that there are no architectural, mechanical or environmental features that would prevent any device from responding to a fire condition;

ix. devices are located correctly; and

x. devices are accessible for maintenance.

IV AUDIT OF AN EXISTING FIRE ALARM SYSTEM

A. INTRODUCTION

The Alberta Fire Code requires that existing fire alarm systems be 'Audited' if a verification of the system has not been performed. AFC 580

However, in practice, if satisfactory evidence of regular maintenance can be supplied the requirements for auditing may be waived by the authority having jurisdiction.

When the building is of a size that requires professional involvement the auditing of the system is to be done under the supervision of a professional engineer who must take professional responsibility for the audit. After problems which are identified by the audit are corrected the professional engineer must re-check the system and certify that it functions as originally intended.

The engineer responsible for the audit of an existing fire alarm system must have training and experience in the installation and functional requirements of the type of fire alarm system, including devices, that is to be audited.

Work must be carried out in compliance with the requirements of the Certification of Electrical Workers Regulation.

It is not the intention, when requiring an audit of an existing fire alarm system, to have the system modified to comply with current codes and regulations.

The audit is carried out to establish if the system is functioning as originally intended. This means that the system is checked in accordance with the code and standards in effect at the time the building was constructed provided the fire alarm system itself has remained unchanged. It is incumbent upon the persons doing the audit to establish that the system does perform the basic function of giving an alarm in the event of fire and to bring to the owner's attention any deficiencies in the placement of devices that will prevent any device from initiating an alarm in response to fire. Where clarification of requirements is necessary the fire authority should be consulted.

The following requirements are from CAN4-S536, "Standard for the Testing, Inspection and Maintenance of Existing Fire Alarm Systems" and outline the details of the procedures to be followed.

level is close to what may be expected during normal building operations;

ii. each audible alarm must be examined to ensure that it operates when required;

iii. a test is to be conducted by means of an alarm initiating device and must include both alert and alarm modes in a two stage system;

iv. ensure that the requirements given for silencing of alarms in section IID2 on page 15 are met;

v. testing must be done on both normal power and emergency power.

(b) Visual

Required additional tests are:

i. ensure that the visual signal can be seen from all locations in rooms, corridors or open spaces served by the visual signal;

ii. this test is to be conducted by initiating an alarm signal using both normal and emergency power supplies.

7. Annunciators & Recording Devices

Required additional tests are:

i. inspect and operate to establish compatibility with all other system components, especially the control unit;

ii. ensure that the location of each designated zone is adequately described;

iii. check that the required voltage is present;

iv. test all features incorporated in the annunciator.

8. Voice Communication

Required additional tests are:

i. test that voice communication is comprehensible under normal building operating conditions;

ii. tests are to be conducted using both normal and emergency power.

2. Heat Detectors

Required additional tests are:

i. apply a heat source to resettable or restorable heat detectors to initiate the device's operation;

ii. simulate the electrical operation of non-resettable heat detectors to test them.

NOTE: Either test should result in an alarm signal being initiated.

3. Smoke Detectors - Area

Required additional tests are:

i. introduce smoke, either from burning materials or artificially generated, to the detecting chamber. NOTE: The test should result in an alarm signal being initiated.

4. Duct Type Smoke Detectors

Required additional tests are:

i. actuate to ensure that the appropriate response is initiated and that the fire alarm system is actuated;

ii. examine that the method by which the detector samples balanced air conditions (by a check of field sensitivity and the air velocity within the sampling tubes) to ensure that the installation is in accordance with the manufacturer's instructions.

5. Ultraviolet & Infra-red Detectors

Required additional tests are:

i. verify that the field sensitivity has been set to correctly identify field conditions;

ii. safely simulate a fire condition as recommended by the manufacturer to initiate an alarm condition.

6. Alarm Signals

(a) Audible

Required additional tests are:

i. establish within reasonable judgement that alarm signals can be heard in all areas of the building. The evaluation should be conducted when the noise

iv. all control unit functions operated to verify appropriate response;

v. open circuits, short circuits and ground faults simulated on all relevant internal circuits in order to confirm the appropriate supervisory response;

vi. the system tested under simulated open or ground fault conditions to ensure that it performs its intended function.

12. Transfer of Alarm Signal

Required additional tests are:

i. the system operated and a confirmation returned to the protected premises indicating if the signal has been received.

13. End of Line Device

Required additional tests are:

i. ensure that an end of line device is located at the end of a signal or initiating circuit in a separate box beyond the last initiating or signal device; and in the control unit when the circuits terminate in the control unit.

14. Ancillary Devices

Required additional tests are:

i. check all ancillary functions, e.g., door closers, fan shut downs or system activation signals.

ii. assure that any faults in the ancillary equipment will not interfere with the normal operation of the fire alarm system.

9. Power Supplies

Required additional tests are:

i. establish that normal and emergency power supplies to the alarm system are within the required operating range of the system;

ii. check power supply to establish that there are no means of disconnection, except by a fuse or breaker that only serves the fire alarm system;

iii. the source of power for ancillary devices should be on a breaker or fuse separate from the breaker or fuse supplying power to the control unit;

iv. batteries are to be examined to ensure that they are in good working order, that their charging system functions as intended and that the battery circuit is properly fused.

v. rechargeable type standby batteries should be checked to ensure that they can provide power for one rated load cycle as defined in section IIF2(a) on page 30.

10. Standby Power Supply Generators

Required additional tests are:

i. after disconnection of the main power supply the emergency generator must start automatically within 10 seconds.

ii. the transfer must occur without applying unacceptable voltages to the control equipment.

11. Control Units

Required additional tests are:

i. all control unit equipment tested to establish that it functions as intended;

ii. a visual and physical inspection of all cables, plug interconnections, plug-in circuit components, lamps, sockets and controls done to establish that their mechanical and electrical connections and mounting are as required for intended function and, where applicable, to confirm electrical supervision;

iii. all lamps and indicators tested for operation and intended function;

APPENDIX B

High Buildings

Experience with high buildings has shown that the time required for complete evacuation can exceed that which is considered necessary for the safe egress of all occupants. Studies of the "chimney effect" and observations of smoke movement in actual fires have shown that present measures for containing a fire on any one storey will not usually prevent the movement of smoke through elevator, stair and other vertical shafts to the upper floors of high buildings. Occupants of high buildings, and particularly those on upper storeys, may therefore be faced with severe smoke conditions from fires occurring in storeys below them before their own evacuation is possible. The measures described in Subsection 3.2.6. are designed to maintain safe conditions for occupants of a high building who may have to remain in the building during a fire, and to assist the firefighters by providing efficient access to the fire floor.

It is assumed that all fire situations will be under the direct control of the officer-in-charge of the fire department facility responding to the fire, who will determine the location of the fire, direct smoke control measures and, by means of the central control facility and the voice communication system, arrange for the safe movement of building occupants who have been alerted to the emergency condition by the fire alarm system.

Subsection 3.2.6. contains only those items that relate to the design and construction of a building. Operation of the facilities and recommended actions to be taken by the building owner, occupant and fire department are subjects covered by the Alberta Fire Code.

Measures that relate to limiting or controlling the movement of smoke caused by a building fire are described in Chapter 3 of the Supplement to the NBC 1985. Adoption of one of these measures is considered to be an acceptable means of complying with the requirements of Subsection 3.2.6. It is not, however, intended that these measures should be regarded as excluding any other equally effective measure that may be developed.

The provisions of the Alberta Building Code 1985 for High Buildings (Subsection 3.2.6.) apply to:

(a) all buildings of Group A, D, E or F major occupancy classification that have a height, measured between grade and the floor level of the top storey, of more than
   i. 36 m, or
   ii. 18 m and in which the cumulative or total occupant load on or above any storey above grade, other than the first storey, divided by the number of 550 mm units of exit width in all exit stairs at that storey exceeds 300 persons;

(b) all buildings containing a Group B major occupancy on any storey which has a floor level higher than 18 m above grade;

V. MAINTENANCE OF FIRE ALARM SYSTEMS

A. General

The Alberta Fire Code requires that all fire alarm and detection systems be maintained.

The maintenance is only to be done by persons approved by the Fire Commissioner. Application for approval must be submitted to the Fire Commissioner. This would usually include owners or employees of companies which supply or manufacture fire alarm systems, installers of fire alarm systems, or others who can demonstrate their capability. AFC576

To allow for proper maintenance it is essential that access is provided to all equipment at all times.

When a system or part of a system is shut off for repairs or is out of operation for any reason for two hours or more, the fire authority must be notified. It may be necessary to provide trained watchmen to patrol the building until the system is restored.

Maintenance is to be in accordance with the Fire Prevention Branch Bulletin #86-003 which is attached as Appendix C.

C1

Alberta

LABOUR
General Safety Services Division
Fire Prevention Branch

FIRE PREVENTION BRANCH BULLETIN

#86-003

5750-5

1986.07.17

FIRE ALARM AND DETECTION SYSTEM INSPECTION AND TESTING INTERVALS

Purpose

The purpose of this bulletin is to establish a policy concerning the inspection and testing of fire alarm and detection systems. The intervals between tests of fire alarm and detection systems by approved persons as specified in Section 582 of the Alberta Fire Code are more restrictive than those specified by CAN4-S536-82 "Standard for the Testing, Inspection and Maintenance of Existing Fire Alarm Systems".

This bulletin, therefore outlines intervals between tests by approved persons that would be acceptable in those areas of the Province where the responsibility of "fire authority" remains with the Fire Commissioner.

Application

Subsection 1 of Section 582 of the Alberta Fire Code states that; "all components of a fire alarm and detection system shall be inspected and tested by an approved person at intervals of not more than 6 months for electrically supervised systems and monthly for a system that is not electrically supervised, except that longer intervals may be permitted provided the fire authority is satisfied that such intervals between tests do not reduce the reliability of the system or equipment requiring testing."

.../2

(c) all buildings containing a Group B occupancy for patients in bed or infirm persons in any floor area above the third storey; and

(d) all buildings containing a Group C major occupancy on a floor level higher than 18 m above grade.

(e) fire alarm batteries shall be checked to ensure that:

i terminals are clean and lubricated where necessary;

ii terminal clamps are clean and tight where necessary; and

iii electrolight and specific gravity where applicable, are as specified by the manufacturer.

Test C (yearly inspection)

4.4.1.

(a) every reasonable effort shall be made to test all components required in this subsection. In the event that some components cannot reasonable be made accessible, a list of such components and their location shall be included in the report. However, all such components shall be tested at least once every three years;

(b) the fire alarm system shall be operated under general alarm conditions;

(c) a minimum of six manual alarm initiating devices most remote from the standby power supply shall be actuated individually with the main power supply disconnected;

(d) each manual alarm initiating device on each floor, including subgrade areas, shall be activated on the main power supply;

(e) operation of every audible and visual signal appliance shall be ensured during the testing of alarm initiating devices;

(f) each automatic initiating device shall be tested for its intended function in accordance with the manufacturers instructions;

.../4

Subsection 2 states that; "inspection and test methods shall be in conformance with CAN4-S536-82, "Standard for the Testing, Inspection and Maintenance of Existing Fire Alarm Systems. "Subsection 3 allows other inspection and test methods to be used when approved.

The tests referred to in this Bulletin are those tests described in CAN4-S536 and are as follows:

Test A (daily check)

4.2.1.

(a) check the principle and remote trouble lights for trouble indication;

(b) inspection of the AC power-on light shall be carried out to ensure its normal operation only if main power supply failure is not electrically supervised.

TEST B (monthly test)

4.3.1.

(a) one manual alarm initiating device shall be operated on a rotation basis and shall initiate an alarm condition;

(b) intended function of all alarm audible and visual signal appliances shall be ensured;

(c) the annunciator panel shall be checked to ensure that the tested devices annunciate correctly;

(d) intended function of the audible and visual trouble signals shall be ensured; and

.../3

Example 2

An unsupervised fire alarm system with;
(a) more than six manual pull stations; or
(b) more than six automatic devices; and
(c) not having any smoke detection devices or normally closed contact devices on the system.

If the inspecting officer is satisfied that the owner of the building or his agent is completing Test A (daily) and Test B (monthly) then Test C (yearly) shall be performed at intervals not exceeding 12 months by an approved person. If Test A or B are not being done then Test C shall be performed monthly by an approved person.

Example 3

An unsupervised fire alarm system employing the use of;
(a) smoke detection devices.

(NOTE) This type of system is particularly prevalent in small apartment buildings and hotels. In many cases smoke detection is a smoke alarm with a relay device to initiate an alarm signal on the general alarm circuit.

This type of arrangement is highly susceptible to unnoticed failures.

If the inspecting officer is satisfied that the owner of the building or his agent are completing Test A (daily) and Test B (monthly) and in addition every smoke detector is checked for operation at least monthly, then Test C shall be performed annually by an approved person. If Test A or B are not being done then Test C shall be performed monthly by an approved person.

(g) each alarm signalling and alarm initiating circuit and annunciator shall be checked for electrical supervision and trouble indication;

(h) correct annunciation shall be ensured for each initiating device tested; and

(i) the fire alarm system control unit shall be visually checked to ensure that the control unit has not been altered other than as specified by clause 2.3 and 2.4 of CAN4-S536-82.

The above tests are those described as daily, monthly and yearly in CAN4-S536-1982.

Acceptable Intervals

Where the responsibility as the fire authority remains with the Fire Commissioner the intervals between tests as described in Section 582(1) of the Alberta Fire Code will be varied as described below.

Example 1

An unsupervised fire alarm system with;

(a) no more than six fire alarm pull stations;

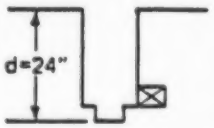
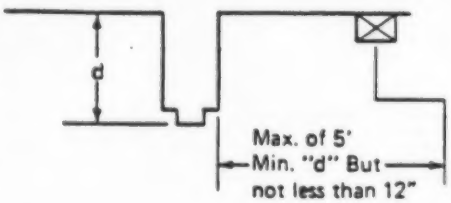
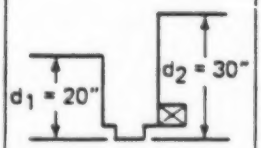
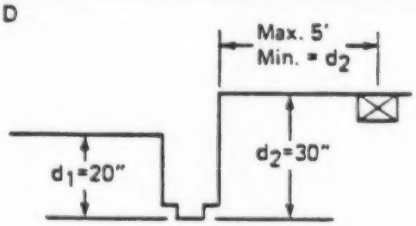
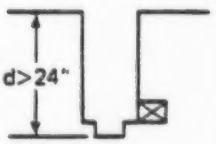
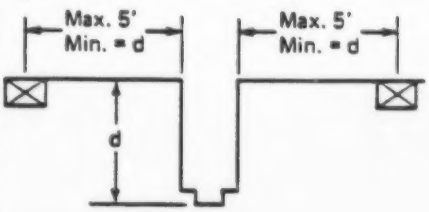
(b) no more than six normally open contact devices (automatic heat detectors); and

(c) audible signal devices (bells).

If the inspecting officer is satisfied that the owner of the building or his agent is completing Test A (daily) and Test B (monthly) then Test C (yearly) shall be performed yearly by an approved person. If Tests A or B are not being done then Test C shall be performed monthly by an approved person.

APPENDIX D

NFPA 80 Detector installation guide for door opening protection.

Depth of Wall Section above door	Door Frame mounted	Ceiling Mounted
"d"	Smoke Detector listed for frame mounting or as part of closer assembly	Smoke Detector Ceiling Mounted
0–24" on both sides of doorway	A  Detector or Detector closer Mounted on either side	B  One detector mounted on either side
Over 24" on one side only	C  Detector or Detector closer Mounted on either side	D  One detector mounted on the higher side
Over 24" on both sides	E  Detector or Detector closer Mounted on either side	F  Two detectors required
Over 60"	G May require additional detectors	

Example 4

A supervised fire alarm system, standard type:

If the inspecting officer is satisfied that the owner of the building or his agent are completing Test A (daily) and Test B (monthly) then he shall require Test C to be performed yearly by an approved person. If Test A or B are not being done then Test C shall be performed at intervals not exceeding 6 months by an approved person.

Example 5

Fire alarm systems having addressible devices. (micro - processor)

This type of system gives a continuous status report on all devices and in most cases will identify via video display or printed message the condition of the system at any time. If the inspecting officer is satisfied that the owner of the building or his agent are completing Test A or making daily reference to the video display or printed readout and completing Test B (monthly) then Test C shall be performed yearly by an approved person. If Test A or B are not being done then Test C shall be performed at intervals not exceeding 6 months by an approved person.

NOTE 1 An approved person is one who has applied for and received a letter or a card from the Fire Commissioner approving him to perform maintenance work on fire alarm systems.

NOTE 2 Only certified electrical workers are allowed to perform connection and disconnection of live electrical components.

FIRE ALARM SYSTEM VERIFICATION

_____ on behalf of
(Name of Company Performing Verification)

_____
(Name of Building Owner or Designer/Design Engineer)

has carried out an on-site verification of the Fire Alarm System installed at:

_____
(Address Where Verification Performed) (City/Town)

This verification was carried out in accordance with U.L.C. Standard CAN4-S537-82 "Standard for Verification of Fire Alarm System Installations" as required by The Alberta Building Code.

_____ hereby confirm
(Name of Company Performing Verification)

that on _____ The Fire Alarm System as installed was
(Month) (Day) (Year)

reviewed for conformance with drawings and specifications originally prepared by

_____ and subsequently
(Name of Designer/Design Engineer)

updated to "As-Built Status: by: _____
(Name of Electrical Contractor)

The Fire Alarm System was tested, on _____ and found to be
(Month) (Day) (Year)
fully operational in accordance with:

(a) The Alberta Building Code 19__,

(b) The Canadian Electrical Code, Part 1 CC22.1-1982,

(c) U.L.C. Standard CAN4-S524-82
"Standard for the Installation of Fire Alarm Systems."

_____
Name of Company or Person Performing Verification

_____
(Signature of Person Responsible for Verification)

Note: Modification to the Fire Alarm System after _____
will invalidate this verification. (Month) (Day) (Year)

Seal of Engineer
Responsible for
Verification

Permit to Practice